IN THE SPECIFICATION:

Please amend the first full paragraph on Page 25, beginning on line 8 and ending on Page 26, line 15 to read as follows:

In the first aspect of the present invention which uses the element temperature model taking into account heat transfer between the active element and the exhaust gas for estimating the temperature of the active element, the element temperature model should preferably comprise a model which is representative of a change per predetermined time in the temperature of the active element as including a temperature change component depending on the difference between at least the temperature of the active element and the temperature of the exhaust gas held in contact with the active element. In the control apparatus according to the ~~second~~ first aspect, the temperature estimating means should preferably sequentially estimate a temperature change of the active element based on the element temperature model, and accumulatively add an estimated value of the temperature change to an initial value which is set when the internal combustion engine starts to operate, thereby estimating the temperature of the active element. Similarly, in the control method according to the second aspect, while sequentially estimating a temperature change of the active element based on the element temperature model, an estimated value of the temperature change should preferably be accumulatively added to an initial value which is set when the internal combustion engine starts to operate, thereby estimating the temperature of the active element. In the recording medium according to the first aspect, the temperature estimating program should preferably comprise a program for enabling the computer to perform a process of

sequentially estimating a temperature change of the active element based on the element temperature model, and accumulatively adding an estimated value of the temperature change to an initial value which is set when the internal combustion engine starts to operate, thereby estimating the temperature of the active element.

Please amend the first full paragraph on Page 42, beginning on line 4 to read as follows:

In this case, the temperature of the heater which is required to determine a temperature change of the active element based on the element temperature model may be an estimated value (latest value) based on the heater ~~element~~ temperature model. Similarly, the temperature of the active element which is required to determine a temperature change of the heater based on the heater ~~element~~ temperature model may be an estimated value (latest value) based on the element temperature model. The temperature of the exhaust gas which is required to determine a temperature change of the active element based on the element temperature model may be either one of detected and estimated values, as with the first aspect described above. The amount of heating energy supplied to the heater, which is required to determine a temperature change of the heater based on the heater temperature model, may be a control input that is generated in controlling the heater as a quantity for determining the amount of heating energy supplied to the heater or electric power supplied to the heater which is grasped from detected values of a current flowing through and a voltage applied to the heater.

Please amend the first full paragraph on Page 73, beginning on line 3 to read as follows:

An estimated value of the exhaust gas temperature Tgc in the partial exhaust passageway 3c and an estimated value of the temperature Twc (hereinafter referred to as "catalyst temperature Twc") of the catalyst 7 which defines the partial exhaust passageway 3c are determined by respective model equations (8-1), (8-2), shown below, in each cycle time of the processing sequence of the exhaust temperature observer 19. More specifically, the exhaust gas temperature Tgc and the catalyst temperature Twc that are determined by the equations (8-1), (8-2) represent estimated values of the temperatures in the vicinity of the downstream end of the partial exhaust passageway ~~3a~~ 3c, i.e., in the vicinity of the outlet of the catalytic converter 4.

$$Tgc(k+1) = Tgc(k) - Vg \cdot \frac{dt}{Lc} \cdot (Tgc(k) - Tgb(k)) + Ac \cdot dt \cdot (Twc(k) - Tgc(k)) \cdots (8\text{-}1)$$

$$Twc(k+1) = Twc(k) + Bc \cdot dt \cdot (Tgc(k) - Twc(k)) + Cc \cdot dt \cdot (TA(k) - Twc(k)) + Dc \cdot dt \cdot Vg \cdots (8\text{-}2)$$

Please amend the first full paragraph on Page 76 beginning on line 1 to read as follows:

The processing sequence of the exhaust temperature observer 19, as described above, determines estimated values of the exhaust gas temperatures ~~Texe~~ Texg, Tga, Tgb, Tgc, Tgd in the exhaust port 2 of the engine 1 and the partial exhaust passageways 3a, 3b, 3c, 3d successively downstream in each cycle time. The estimated value of the exhaust gas temperature Tgd in the partial exhaust passageway 3d which is located most

downstream corresponds to the temperature of the exhaust gas in the vicinity of the location of the O_2 sensor 8. The estimated value of the exhaust gas temperature Tgd is obtained as the estimated value of the exhaust gas temperature in the vicinity of the location of the O_2 sensor 8.

Please amend the third full paragraph on Page 98, beginning on line 23 and ending on Page 99, line 3 to read as follows:

If F/A = F/B = 0 in STEP5-2, then the heater controller 22 adds the present value of $\sum e(j)$ in the first term of the equation (24) to the difference e(n) calculated in STEP5-1 in ~~STEP5-4~~ STEP5-3. In this manner, the difference e(n) is cumulatively added (integrated) in each cycle time dtc of the processing sequence of the heater controller 22. The initial value of $\sum e(j)$ is "0".

Please amend the second full paragraph on Page 111, beginning on line 12 and ending on line 3 of Page 112 to read as follows:

Then, the element temperature observer 20 executes the processing in STEP16-7 to determine estimated values of the element temperature T_{O2} of the O_2 sensor 8 and the heater temperature Tht according to the equations (10-1), (10-2). Specifically, the element temperature observer 20 determines a new estimated value $T_{O2}(k+1)$ of the device temperature T_{O2} by calculating the right side of the equation (10-1) using the present estimated value $T_{O2}(k)$ (determined in STEP16-7 in the preceding cycle time) of the element temperature T_{O2}, the present estimated value Tht(k) (determined in STEP16-

7 in the preceding cycle time) of the heater temperature Tht, the present estimated value of the exhaust gas temperature Tgd previously calculated in ~~STEP6-6~~ STEP16-6, the values of the predetermined model coefficients Ax, Bx, and the value of the period dt (= the period of the processing sequence of the exhaust temperature observer 19) of the processing sequence of the element temperature observer 20.

Please amend the first full paragraph beginning on line 3 of Page 121 to read as follows:

The above equation (27) is a formula for sequentially calculating a control input DUT(n) (duty cycle) with which the heater controller 32 controls the heater 13 in the present embodiment. Specifically, the heater controller 32 sequentially calculates the control input DUT(n) in each cycle time (period) of the control processing of the heater controller 32 according to the equation (27), and applies a pulse voltage having the duty cycle DUT(n) to a heater energizing circuit, not shown, thereby adjusting the electric power supplied to the heater 13. The terms on the right side of the equation (27) have the same meanings as those in the first embodiment. Specifically, the first through third terms (the term including $\sum e'(j)$ through the term including $T_{O2}(n)$) on the right side represent a control input component (a feedback component based on an optimum control algorithm) depending on the heater temperature difference e' and the element temperature T_{O2}. The fourth term (the term of $\sum Fr'(i) \cdot R'(n+i)$) on the right side of the equation [[(27)]] (24) and the fifth term (the term including Tgd(n)) on the right side thereof

represent a control input component (a feed-forward component based on a predictive control algorithm) depending on the exhaust gas temperature Tgd.